SOLVAY MINERALS

June 13, 2003

Cortnie Morrell
WDEQ-Air Quality Division
122 W. 25th Street
Cheyenne, WY 82002

RE: Additional Information for AP-0631 per May 9, 2003 and May 29, 2003 Requests

Dear Cortnie:

Following is information concerning permit application AP-0631 per the Division's May 9 and May 29, 2003 requests. The permit application is for the fuel conversion of Calciners A and B (AQD #17) from natural gas to coal-firing.

A BACT cost analysis was conducted for achieving an emission rate of 0.01 gr/dscf from the calciners. The analysis was done per EPA Air Pollution Control Cost Manual – Sixth Edition, Section 6 - Particulate Matter Control, Chapter 1 - Baghouses and Filters. Results for a baghouse with an emission rate of 0.01 gr/dscf were $121 per ton of particulate matter removed.

In addition, a BACT cost analysis was conducted on the existing ESPs installed on Calciners A and B (EP-1 and EP-2) with an emission rate of 0.02 gr/dscf. This analysis was done per EPA Air Pollution Control Cost Manual – Sixth Edition, Section 6 - Particulate Matter Control, Chapter 3 – Electrostatic Precipitators. Where available, actual costs were utilized. Since EP-1 and EP-2 were purchased in 1981, the costs of the ESP on Calciner C (EP-5) were used. EP-5 was purchased in 1990, and is more similar in size to EP-1 and EP-2 than the ESP on Calciner D (EP-7), which was purchased in 1997. The collection surface areas for EP-1 and EP-2 are 115,200 ft^2 each, for EP-5 is 213,151 ft^2, and for EP-7 is 249,553 ft^2. (Actually, the costs of EP-5 and EP-7 were similar at $1,703,413 for EP-5 and $1,776,871 for EP-7.) Actual maintenance labor costs from 2002 on EP-1 were also used. The labor costs were adjusted up to account for the unit not operating 8760 hours last year. Results of the analysis were $15 per ton of particulate matter removed.

The incremental cost to control particulate emissions to 0.01 gr/dscf using the existing base case of controlling to 0.02 gr/dscf is $84,523 per ton. This is based on an emission rate of 90.2 tpy with an ESP rated at 0.02 gr/dscf at an annual cost of $549,000 and an emission rate of 45.1 tpy with a baghouse rated at 0.01 gr/dscf at an annual cost of $4,361,000. The 45.1 tpy increment would cost $3,812,000 annually, which is an annual cost of $84,523 per

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ton particulate removed. These analyses show that the existing ESPs controlling to 0.02 gr/dscf is BACT for this fuel conversion project for Calciners A and B.

Concerning the use of flue gas recirculation and water injection for NO_X control, these control technologies will operate on a continuous basis to obtain the emission rate of 0.45 lb NO_X/MMBtu.

If you have any questions concerning this submittal, please contact me at (307) 872-6571.

Respectfully submitted,

Dolly A. Potter
Environmental Services Supervisor

Enclosures

cc: Tony Hoyt w/o enclosures

Economic Analysis for BACT Option of a Baghouse rated at 0.010 gr/dscf
Solvay Minerals, Inc.
Calciners A & B Fuel Switch
AP-0631

Main Reference:

EPA Air Pollution Control Cost Manual - Sixth Edition (EPA 452/B-02-001)
Section 6 - Particulate Matter Controls
Chapter 1 - Baghouses and Filters December, 1998

Notes:

This cost analysis is directed to evaluating the cost implementing baghouse technology to replace existing ESP's to meet 0.010 Gr/DSCF. Solvay Minerals, Inc. has determined that is is more cost effective to keep the existing ESP's which emit 0.02 Gr/DSCF.

Basis

		Reference
1	One of two baghouses replacing one of two precipitators is basis of calculations	
325,000	ACFM calciner offgas	*Permit Application*
156,407	SCFM @ 60F calciner offgas	*Calculated*
120,000	DSCFM @ 60F calciner offgas	*Permit Application*
400	Deg F flue gas temperatrue	*Permit Application*
11.70	Ambient atmos pressure, psia	*Ambient Pressure Data*
14.70	Std atmos pressure	*Standard Atmospheric Pressure*
20.6	ESP Pph particulate emission at 0.02 gr/dscf	*Permit Application*
10.3	Baghouse pph particulate emission at 0.01 gr/dscf	*Calculated for baghouse*
$	Dollars expressed in USD	

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Existing ESP

2	Buell Model BA 1.1X50L4334-4.T, plate and weighted wire, purchased August 11, 1981, handling calcined ore (soda ash) dust (90 - 95%), fly ash, silica, shale, shortite (5 - 10%)	*Purchase Order 037-1268-000-01400 Specifications*
8	Gr/DSCF inlet loading	*Assumed*
0.02	Gr/DSCF existing guaranteed outlet loading	*Stack test results (from archives, operating with coal)*
99.75	ESP guaranteed efficiency percent	*Calculated and PO specifications*

Baghouse with Desired Efficiency to Achieve 0.010 Gr/DSCF

8	Gr./DSCF inlet loading	*Assumed*
0.01	Gr./DSCF existing estimated outlet loading	*Estimated from BACT*
99.875	Desired efficiency percent	*Calculated*

Design and Size Baghouse to Achieve 0.010 Gr/DSCF

Design Gas-to-Cloth Ratio -- Two Methods

1	Pulse-jet cleaning is chosen based on reduced size, capital cost, and Solvay experience with this type of equipment.	*EPA Air Pollution Cost Manual, Section 6, Chapter 1.2.3 Section 6, Chapter 1.2.3*
	Method 1	
5.000	Standard gas-to-cloth ratio (acfm divided by net cloth area in square feet)	*Solvay Minerals, Inc. standard based on experience*
	Method 2	
	Gas-to-cloth ratio V according to EPA calculation 1.11	*Chapter 1.3.1.2 Page 1-23*
12	A = material factor for soda ash	*Table 1.4*
0.8	B = application factor for process gas filtration for kilns, dryers, etc.	*Table 1.4*
400	T = temperature F	*Permit Application*
8	Gr./DSCF inlet loading	*Assumed*
325000	ACFM calciner offgas	*Permit Application*
120000	DSCFM @ 60F calciner offgas	*Permit Application*
960002	Gr inlet loading/min	*calculated*
2.954	L = inlet dust loading Gr./cu ft	*calculated*
17	D = mass mean diameter micron	*Jenike & Johanson "Flow Properties Test Report" 10/20/95 SC-17 coal calciner precipitator sample.*
5.015	Gas-to-cloth ratio V ft/min	*Calculated, using formula Chapter 1.3.1.2 Page 1-23*
5.000	Selected gas-to-cloth ratio, lower of two	*Assumption*
65,000	Net Cloth Area, sq ft	*calculated*
1.1	Multiplier to obtain Gross Cloth Area	*Chapter 1.3.1.2 Table 1.2*
71,500	Gross Cloth Area, sq ft	*calculated*

Gas Stream Characteristics, Special Design for..

negligible	Corrosion and moisture content	*Solvay's experience with calciner offgas handling*
negligible	Temperature, dewpoint problems (well above dewpoint of 160F, below maxiumum rating of fabrics)	*Solvay's and baghouse vendors' experience, Table 1.6*
negligible	Pressure problems (less than + or - 25" wc)	*Solvay's experience with calciner offgas handling*

Equipment Cost

648,818	Pulse-Jet modular equipment cost, $, cost w/o bags, 2nd qtr 1998 *	*EPA Air Pollution Cost Manual, Figure 1.9*
195,930	Add-on for insulation cost, $, 2nd qtr 1998 *	*EPA Air Pollution Cost Manual, Figure 1.9*
	* Note: costs have not changed significantly since 1998	
9.70	Bag costs for 22 oz Teflon felt for 500F temperature peak, 6" to 8" diameter, top bag removal, $/sq ft, 2nd qtr 1998	*EPA Air Pollution Cost Manual, Table 1.8*
693,550	Bag cost $	*calculated*
15.7	Fabric area/cage, 10' long, calculate 6"/12" x pi x 10 ft = 15.7 sq ft/cage	*EPA Air Pollution Cost Manual, example page 1-51*
4,552	Number of cages	*calculated*
12.07	Cage costs $ each, 5-5/8" x 10' cage, mild steel, roll band top, formula 2.5212 x area exp 0.5686	*EPA Air Pollution Cost Manual, Table 1.8*
54,942	Total cage cost, $	*calculated*
1,593,239	Purchased equipment cost, PEC, baghouse + insulation + bags + cages	*Calculated*
1.5	Factor for retrofit (site preparation and new building assumed not required) (factor for retrofit 1.3 to 1.5 is suggested, based on difficulty)	
2,389,859	Purchased equipment cost, PEC, baghouse + insulation + bags + cages, retrofitted	
1.18	Factor for instrumentation, sales tax, freight	*EPA Air Pollution Cost Manual, Table 1.9*
2,820,034	**Direct Costs B $**	*Calculated*
0.74	Factor for direct installation costs, percent of B/100	*EPA Air Pollution Cost Manual, Table 1.9*
2,086,825	Direct Installation Costs	*Calculated*
4,906,858	**Total Direct Cost**	*Calculated*
0.45	Indirect Cost Installation factor, percent of B/100	*EPA Air Pollution Cost Manual, Table 1.9*
1,269,015	**Total Indirect Cost, IC**	*Calculated*

Total Capital Investment

2.19	Factor for direct and indirect installation costs (DC + IC), percent of B/100	*EPA Air Pollution Cost Manual, Table 1.9*
	(This assumes the new equipment will fit existing space. Site preparation and building costs are assumed to be negligible.)	
6,175,873	**Total Capital Investment TCI**	*Calculated*
6,175,873	check using 2.19 factor	*Calculated*

Total Annual Cost

	DIRECT	
251,850	Operating labor $50/H (4 hr/shift, 3 shifts per day = 12 hr/day) + 15% supervisory labor	*Estimated*
109,500	Maintenance labor $50/H (2 hr/shift, 3 shifts per day = 6 hr/day)	*Estimated*
109,500	Maintenance material 100% of Maintenance Labor	*EPA Air Pollution Cost Manual*
	Replacement cost	
435,264	Bag cost including taxes and freight adjusted with CFR of 0.55309 (based on 7% and 20 yr life)	*EPA Air Pollution Cost Manual (equation 1.13)*
	Electricity	
10	Pressure drop in inches of water	*Estimated*
5,153,070	KWh/yr = 0.000181 X acfm X pressure drop X operating time	*EPA Air Pollution Cost Manual, equation 1.14*
0.033	$/kwh electrical cost	*Estimated*
170,051	Electrical power $ cost per year	*Estimated*
	Compressed air	
650	Compressed scfm air based on 2 scfm/1000 cfm of gas filtered	*EPA Air Pollution Cost Manual, page 1-48*
6,632,001	Compressed air Mscf/y	*Calculated*
1,658,000	Cost of compressed air $/Y based on $0.25/1000 scf in 1998 dollars	*EPA Air Pollution Cost Manual, page 1-48*
2,734,165	Total Direct Cost (DC)	*Calculated*
	INDIRECT	
282,510	Overhead 60% of op labor, maint labor, and maintenance material	*EPA Air Pollution Cost Manual*
123,517	Administrative charges 2% of total capital investment TCI	*EPA Air Pollution Cost Manual*
61,759	Property tax 1% of TCI	*EPA Air Pollution Cost Manual*
61,759	Insurance 1% of TCI	*EPA Air Pollution Cost Manual*
	Capital Recovery	
513,912	CRF X (capital investment - bag cost including taxes and freight and labor cost for replacing bags)	

EPA Section 1, Chapter 1, page1-48			
Life of project n	20	years	*EPA Air Pollution Cost Manual*
Interest rate =	7	%	*EPA Air Pollution Cost Manual*
CRF = i(1 +i)nth power/((1 + i)nth power -1)			*Interest rate per Stephen Kovar, Solvay Minerals, Inc.*
1 + i =	1.07		*EPA Air Pollution Cost Manual*
CRF =	0.09439		*Calculated*
			Calculated

582,959	Capital recovery assuming (	0.09439	interest =	7	%	*Calculated*
1,626,416	Total Indirect Cost (IC)					
4,360,581	**Total Annual Cost (each baghouse)**					
4,361,000	**Total Annual Cost (rounded, each baghouse)**					

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Particulate Emissions

36,041	Uncontolled particulate emissions at (tpy) 8 gr/dscf	*Calculated*
45.1	Particulate emissions (tpy) controlled to 0.01 gr/dscf (one baghouse, 10.3 pph)	*Calculated*
35,995.9	Particulate reduction (tpy)	*Calculated*

Cost Effectiveness

$121	**USD per ton of additional particulate removed**	*Calculated*

Annual ESP Costs
Solvay Minerals, Inc.
Calciners A & B Fuel Switch
Precipitators EP -1 and EP-2
AP-0631

Main Reference:

EPA Air Pollution Control Cost Manual - Sixth Edition (EPA 452/B-02-001)
Section 6 - Particulate Matter Controls Chapter 3 - Electrostatic Precipitators 7-10-02
Solvay Minerals documents

Notes:

This cost analysis is directed to evaluating the annaul cost of the existing ESPs installed on Calciners A and B
Solvay Minerals, Inc. has determined that is is more cost effective to operate the existing ESP's rather than a baghouse

Basis

			Reference
1	Of two precipitators is used in basis of calculations		
325,000	ACFM calciner offgas		*Permit Application*
156,407	SCFM @ 60F calciner offgas		*Calculated*
120,000	DSCFM @ 60F calciner offgas		*Permit Application*
400	Deg F flue gas temperatrue		*Permit Application*
11.70	Ambient atmos pressure, psia		*Ambient Pressure Data*
14.70	Std atmos pressure		*Standard Atmospheric Pressure*
20.6	Pph particulate emission at 0.02 gr/dscf		*Permit Application*
$	Dollars expressed in USD		

Existing Equipment

2	Buell Model BA 1.1X50L4334-4.T, plate and weighted wire, purchased August 11, 1981, handling calcined ore (soda ash) dust (90 - 95%), fly ash, silica, shale, shortite (5 - 10%)		*Purchase Order 037-1268-000-01400 Specifications*
8	Gr/DSCF inlet loading		*Assumed*
0.02	Gr/DSCF existing guaranteed outlet loading		*Stack test results (from archives, operating with coal)*
99.75	Guaranteed efficiency percent		*Calculated and PO specifications*
4.52	Gas velocity ft/sec		*Calculated*
1199	Cross sectional area sq ft		*PO specifications*
0.24	Migration velocity ft/sec (from Buell design criteria	7.33 cm/sec	*PO specifications*
115,200	Total collecting plate area installed		*PO specifications*
354	SCA collecting area/1000 ACFM installed		*PO specifications*
1.125	Aspect ratio installed		*PO specifications*

Capital Costs EP-1 and EP-2

Direct Costs

1,703,413	Electrostatic Precipitator (includes transformers, rapper controls, hoppers, etc.)	*EP-5 cost 1990*
500,000	Screws, bins, hoppers, shutes, stack	*Cost Estimate*
2,203,413	Sum A	
220,341	Instrumentation, 0.1A	*EPA Air Pollution Cost Manual*
121,188	Sales Taxes, 0.055A	*5.5% sales tax*
88,980	Freight	*EP-5 cost 1990*
430,509	Purchased equipment cost B	
2,633,922	Total Direct Costs, DC	

Indirect Costs

245,390	Indirect costs, 0.57B	*EPA Air Pollution Cost Manual*

Total Capital Investment (TCI)

2,879,312	**Total Capital Investment TCI (each precipitator)**	*PEC and auxilliary costs*

Total Annual Cost

	DIRECT	
20,988	Operating labor $50/H (1 hr/day) + 15% supervisory labor	*Estimated*
9,817	Maintenance labor ($5,621 actual 2002 costs with 5016 operating hrs)	Actual 2002 labor cost for EP1, adjusted to 8760 hrs
28,793	Maintenance material 1% of PEC (use TCI)	*EPA Air Pollution Cost Manual*
66,564	Operating electricity based on .00194 kWh per sq ft collecting area and 3.4 cents per kWh	*EPA Air Pollution Cost Manual*
126,161	Total Direct Cost (DC)	
	INDIRECT	
35,758	Overhead 60% of op labor, maint labor, and maintenance material	*EPA Air Pollution Cost Manual*
57,586	Administrative charges 2% of total capital investment TCI	*EPA Air Pollution Cost Manual*
28,793	Property tax 1% of TCI	*EPA Air Pollution Cost Manual*
28,793	Insurance 1% of TCI	*EPA Air Pollution Cost Manual*

Total Annual Cost (continued)

	EPA Section 1, Chapter 2, page 2-21	*EPA Air Pollution Cost Manual*
	Life of project n 20 years	*EPA Air Pollution Cost Manual*
	Interest rate = 7 %	*Estimated*
	CRF = i(1 +i)nth power/((1 + i)nth power -1)	*EPA Air Pollution Cost Manual*
	1 + i = 1.07	*Calculated*
	CRF = 0.094393	*Calculated*
271,787	Capital recovery assuming 0.09439 , interest = 7 %	*Calculated*
422,718	Total Indirect Cost (IC)	
548,878	**Total Annual Cost (each precipitator)**	
549,000	**Total Annual Cost (rounded, each precipitator)**	

Particulate Emissions

36,041	Uncontolled particulate emissions (tpy) at 8 gr/dscf	*Calculated*
90.2	Particulate emissions (tpy) controlled to 0.02 gr/dscf	*Calculated*
35,950.8	**Particulate controlled (tpy)**	*Calculated*

Cost Effectiveness

$15	**Cost per ton of particulate controlled**	*Calculated*

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